Design of Question Paper

Mathematics - Class X

Time: Three hours **Max. Marks: 80**

Weightage and distribution of marks over different dimensions of the question paper shall be as follows:

A. Weightage to content units

S. No.	Content Units	Marks
1.	Number systems	04
2.	Algebra	20
3.	Trigonometry	12
4.	Coordinate Geometry	08
5.	Geometry	16
6.	Mensuration	10
7.	Statistics & Probability	10
	Total	**80**

B Weightage to forms of questions

S. No.	Forms of Questions	Marks of each Question	No. of Questions	Total Marks
1.	Very Short answer questions (VSA)	01	10	10
2.	Short answer questions-I (SAI)	02	05	10
3.	Short answer questions-II (SAII)	03	10	30
4.	Long answer questions (LA)	06	05	30
		Total	**30**	**80**

C. Scheme of Options

All questions are compulsory. There is no overall choice in the question paper. However, internal choice has been provided in one question of two marks each, three questions of three marks each and two questions of six marks each.

D. Weightage to difficulty level of Questions

S. No.	Estimated difficulty level of questions	Percentage of marks
1.	Easy	15
2.	Average	70
3.	Difficult	15

Based on the above design, separate Sample papers along with their blue print and marking scheme have been included in this document for Board's examination. The design of the question paper will remain the same whereas the blue print based on this design may change.

Mathematics-X Blue Print I

Form of Questions Unit	VSA (1 Mark) each	SA I (2 Marks) each	SA II (3 Marks) each	LA (6 Marks) each	Total
Number systems	1(1)	—	3(1)	—	4(2)
Algebra	3(3)	2(1)	9(3)	6(1)	20(8)
Trigonometry	1(1)	2(1)	3(1)	6(1)	12(4)
Coordinate Geometry	—	2(1)	6(2)	—	8(3)
Geometry	2(2)	2(1)	6(2)	6(1)	16(6)
Mensuration	1(1)	—	3(1)	6(1)	10(3)
Statistic and Probability	2(2)	2(1)	—	6(1)	10(4)
Total	**10(10)**	**10(5)**	**30(10)**	**30(5)**	**80(30)**

Sample Question Paper - I

Mathematics - Class X

Time: Three hours **Max. Marks: 80**

General Instructions:

1. All Questions are compulsory.

2. The question paper consists of thirty questions divided into 4 sections A, B, C and D. Section A comprises of ten questions of 01 mark each, section B comprises of five questions of 02 marks each, section C comprises of ten questions of 03 marks each and section D comprises of five questions of 06 marks each.

3. All questions in Section A are to be answered in one word, one sentence or as per the exact requirement of the question.

4. There is no overall choice. However, internal choice has been provided in one question of 02 marks each, three questions of 03 marks each and two questions of 06 marks each. You have to attempt only one of the alternatives in all such questions.

5. In question on construction, drawings should be neat and exactly as per the given measurements.

6. Use of calculators is not permitted. However, you may ask for mathematical tables.

Section A

1. Write the condition to be satisfied by q so that a rational number $\frac{p}{q}$ has a terminating decimal expansion.

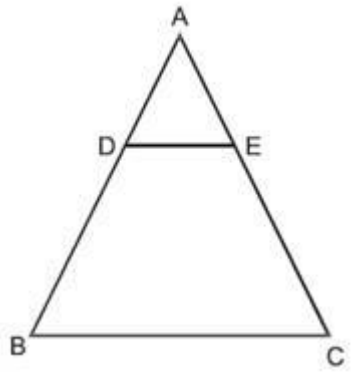
2. The sum and product of the zeroes of a quadratic polynomial are - ½ and -3 respectively. What is the quadratic polynomial?

3. For what values of k the quadratic equation $x^2 - kx + 4 = 0$ has equal roots?
4. Given $tan\theta = \frac{1}{\sqrt{5}}$, what is the value of $\frac{cosec^2\theta - sec^2\theta}{cosec^2\theta + sec^2\theta}$?

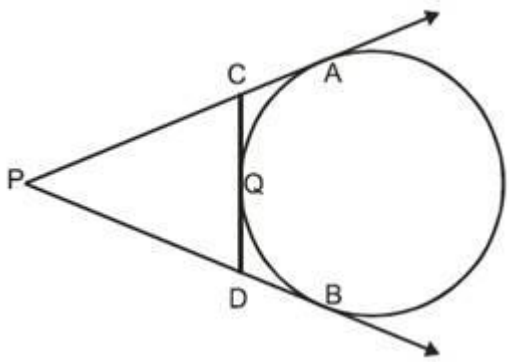
5. Which term of the sequence 114, 109, 104, ... is the first negative term?

6. A cylinder, a cone, and a hemisphere are of equal base and have the same height. What is the ratio in their volumes?

7. In the figure given below, DE is parallel to BC and AD = 1cm, BD = 2cm. What is the ratio of the area of ABC to the area of ADE?

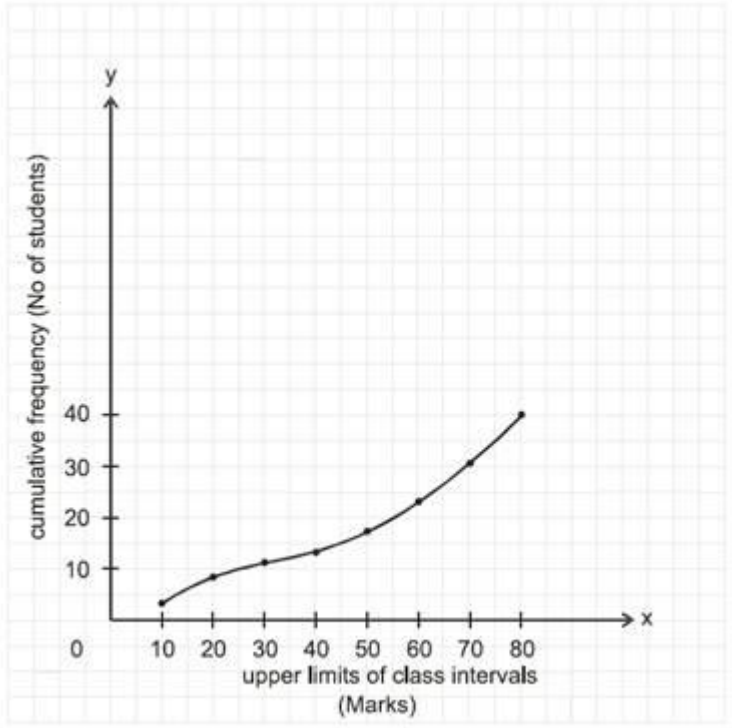


8. In the figure given below, PA and PB are tangents to the circle; drawn from an external point P. CD is the third tangent touching the circle at Q. If PB = 10 cm, and CQ = 2 cm, what is the length of PC?



9. Cards each marked with one of the numbers 4, 5, 6....20 are placed in a box and mixed thoroughly. One card is drawn at random from the box. What is the probability of getting an even prime number?

10. A student draws a cumulative frequency curve, for the marks obtained by 40 students of a class, as shown below. Find the median marks obtained by the students of the class.



Section B

11 Without drawing the graphs, state whether the following pair of linear equations will represent intersecting lines, coincident lines or parallel lines: 6x - 3y + 10 = 0 2x - y + 9 = 0 Justify your answer.

12. Without using trigonometric tables, find the value of

$$\frac{\cos 70^\circ}{\sin 20^\circ} + \cos 57^\circ \; cosec \; 33^\circ - 2\cos 60^\circ$$

13 Find a point on the y-axis, which is equidistant from the points A (6, 5) and B (- 4, 3).

14 In the figure given below, AC is parallel to BD, Is $\frac{AE}{CE} = \frac{DE}{BE}$? Justify your answer.

15 A bag contains 5 red, 8 green and 7 white balls. One ball is drawn at random from the bag, find the probability of getting (i) a white ball or a green ball. (ii) neither a green ball not a red ball. OR One card is drawn from a well shuffled deck of 52 playing cards. Find the probability of getting (i) a non-face card (ii) a black king or a red queen.

Section C

16 Using Euclid's division algorithm, find the HCF of 56, 96 and 404. OR Prove that $3 - \sqrt{5}$ is an irrational number.

17 If two zeroes of the polynomial $x^4 + 3x^3 - 20x^2 - 6x + 36$ are $\sqrt{2}$ and $-\sqrt{2}$, find the remaining zeroes of the polynomial.

18. Draw the graph of the following pair of linear equations x + 3y = 6 2x - 3y = 12 Hence, find the area of the region bounded by the x = 0, y = 0 and 2x - 3y = 12.

19 A contract on a construction job specifies a penalty for delay of completion beyond a certain date as follows: Rs 200 for first day, Rs. 250 for second day, Rs. 300 for third day and so on. If the contractor pays Rs 27750 as penalty, find the number of days for which the construction work is delayed.

20. Prove that:

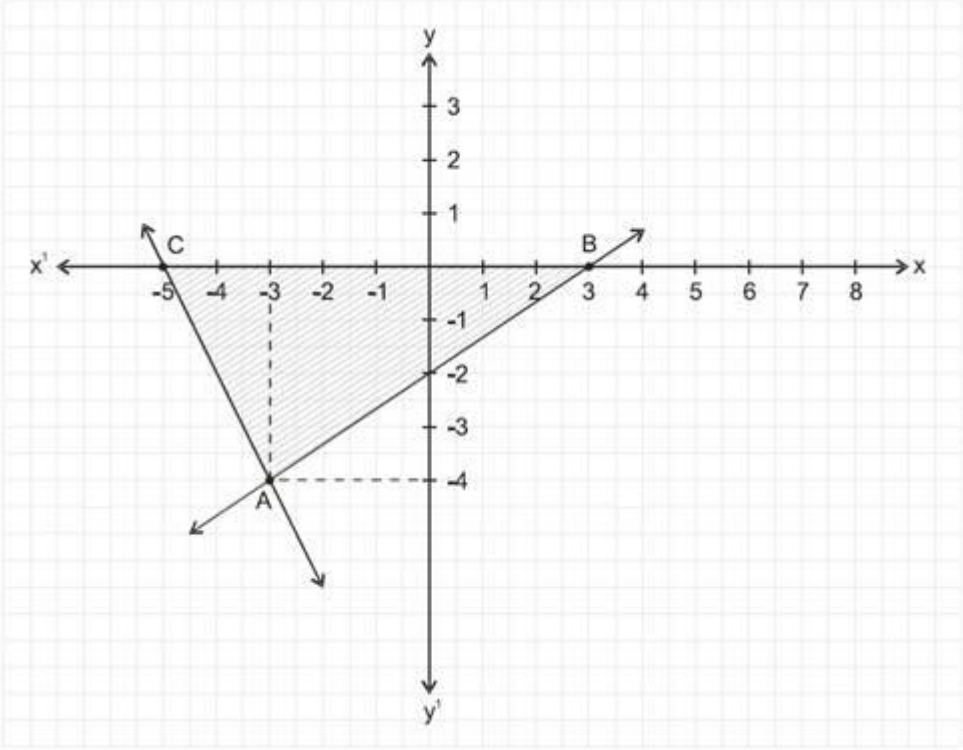
$$\frac{1+\cos A}{\sin A}+\frac{\sin A}{1+\cos A}=2\ cosec\ A$$

OR

Prove that:

$$\frac{\sin A+\cos A}{\sin A}+\frac{\sin A-\cos A}{1+\cos A}=2cosec\ A$$

21 Observe the graph given below, and state whether triangle ABC is scalene, isosceles or equilateral. Justify your answer. Also find its area.



22 Find the area of the quadrilateral whose vertices taken in order are A (-5, -3), B (-4, -6), C (2, -1) and D (1, 2).

23 Construct a

Δ ABC in which CA = 6 cm, AB = 5cm and BAC = 45°, then construct a triangle similar to the given triangle whose sides are

$\frac{6}{5}$ of the corresponding sides of the

Δ ABC.

24 Prove that the intercept of a tangent between two parallel tangents to a circle subtends a right angle at the centre of the circle.

25 A square field and an equilateral triangular park have equal perimeters. If the cost of ploughing the field at rate of Rs 5/m^2 is Rs 720, find the cost of maintaining the park at the rate of Rs 10/m^2. OR An iron solid sphere of radius 3 cm is melted and recast into small spherical balls of radius 1 cm each. Assuming that there is no wastage in the process, find the number of small spherical balls made from the given sphere.

Section D

26 Some students arranged a picnic. The budget for food was Rs 240. Because four students of the group failed to go, the cost of food to each student got increased by Rs 5. How many students went for the picnic? OR A plane left 30 minutes late than its scheduled time and in order to reach the destination 1500 km away in time, it had to increase the speed by 250 km/h from the usual speed. Find its usual speed.

27 From the top of a building 100 m high, the angles of depression of the top and bottom of a tower are observed to be 45° and 60° respectively. Find the height of the tower. Also find the dist**a**nce between the foot of the building and bottom of the tower. OR The angle of elevation of the top a tower at a point on the level ground is 30°. After walking a distance of 100 m towards the foot of the tower along the horizontal line through the foot of the tower on the same level ground, the angle of elevation of the top of the tower is 60°. Find the height of the tower.

28 Prove that in a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides. Using the above, solve the following: A ladder reaches a window which is 12 m above the ground on one side of the street. Keeping its foot at the same point, the ladder is turned to the other side of the street to reach a window 9 m high. Find the width of the street if the length of the ladder is 15 m.

29. The interior of a building is in the form of a right circular cylinder of radius 7 m and height 6 m, surmounted by a right circular cone of same radius and of vertical angle 60°. Find the cost of painting the building from inside at the rate of Rs 30/m^2.

30 The following table shows the marks obtained by 100 students of class X in a school during a particular academic session. Find the mode of this distribution.

Marks	**No. of students**
Less than 10	7
Less than 20	21
Less than 30	34
Less than 40	46
Less than 50	66
Less than 60	77
Less than 70	92
Less than 80	100

Marking Scheme

Sample Question Paper I

X- Mathematics

Q. No.	Value points	Marks
	Section A	
1	q should be expressible as $2^x \cdot 5^y$, where x and y are whole numbers.	1
2	$2x^2 + x - 6$	1
3	± 4	1
4	$\frac{2}{3}$	1
5	24th	1
6	3 : 1 : 2	1
7	9 : 1	1
8	8 cm	1
9	0	1
10	55	1
	Section A	
11	Parallel lines Here,	½
	$\frac{a_1}{a_2} = 3, \frac{b_1}{b_2} = 3, \frac{c_1}{c_2} = \frac{10}{9}$	½
	$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ Given system of equations will represent parallel lines.	½
12	cos 70° = sin (90° - 70°) = sin 20° cos 57° = sin (90°-57°) = sin 33° ½ cos60° = ½	½
	$\frac{\cos 70°}{\sin 20°} + \cos 57° \, cosec \, 33° - 2\cos 60°$	½
	$\frac{\sin 20°}{\sin 20°} + \cos 33° \, cosec \, 33° - 2 \times \frac{1}{2}$ = 1 +1 -1 =1	½
		½
13	Let (0, y) be a point on the y-axis, equidistant from A (6, 5) and B (-4, 3).	½
	$PA = \sqrt{y^2 - 10y + 61}$	½
	$PB = \sqrt{y^2 - 6y + 25}$ Now, PA = PB	
	$\Rightarrow$ $(PA)^2 = (PB)^2$ i.e. $y^2 - 10y + 61 = y^2 - 6y + 25$ y = 9 Required point is (0, 9).	1
		½
14	Yes DACE ~ DDBE (AA similarity)	½
	$\frac{AC}{BD} = \frac{CE}{BE} = \frac{AE}{DE}$	
	$\frac{AE}{CE} = \frac{DE}{BE}$	1

½

15 (i) P (White or green ball) = 1

$\frac{15}{20} = \frac{3}{4}$ (ii) P (Neither green nor red) = 1

$\frac{7}{20}$ OR (i) P (non-face card) = 1

$\frac{40}{52} = \frac{10}{13}$ (ii) P (black king or red queen) = 1

$\frac{4}{52} = \frac{1}{13}$

16 **Section C** Using Euclid's division algorithm, we have 96 = 56 x 1 + 40 56 = 40 x 1 + 16 40 = 2
16 x 2 + 8 16 = 8 x 2 + 0 \ HCF of 56 and 96 is 8. Now to find HCF of 56, 96 and 404 we apply Euclid's division algorithm to 404 and 8 i.e., 404 = 8 x 50 + 4 8 = 4 x 2 + 0 \ 4 is the required HCF. OR Let ½

$3 - \sqrt{5}$ be a rational number, say x.

$\therefore 3 - \sqrt{5} = x$ ½

$\Rightarrow \sqrt{5} = 3 - x$ Here, R.H.S is a rational number, as both 3 and x are so. ½

$\Rightarrow \sqrt{5}$ is a rational number proving that

$\sqrt{5}$ is not rational \ Our supposition is wrong

$\Rightarrow 3 - \sqrt{5}$ is an irrational number.

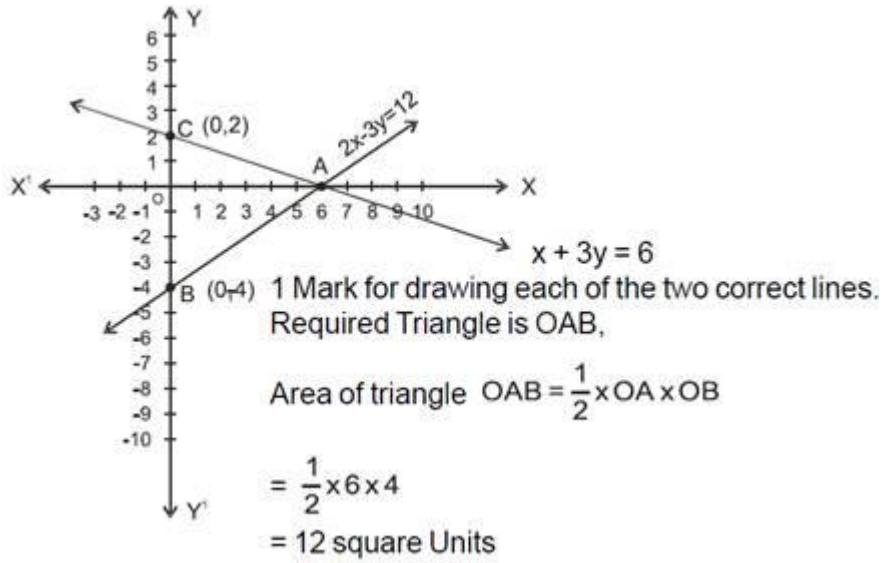
17 Since 1

$\sqrt{2}$ and

$-\sqrt{2}$ are two zeroes of the polynomial 1

$\therefore (x - \sqrt{2})(x + \sqrt{2})$ is a factor of the polynomial. By long division method, $X^4 +$ 1
$3x^3 - 20x^2 - 6x + 36 = (x^2 - 2)(x^2 + 3x - 18) = (x^2 - 2)(x + 6)(x - 3)$ \ The remaining zeroes of the Polynomial are –6 and 3.

18 2



1

1 Mark for drawing each of the two correct lines.
Required Triangle is OAB,

Area of triangle $OAB = \frac{1}{2} \times OA \times OB$

$= \frac{1}{2} \times 6 \times 4$

= 12 square Units

19 Let the delay in construction work be for n days. Here a = 200, d = 50, Sn = 27750. ½

$S_n = \frac{n}{2}[2 \times 200 + (n - 1)d]$

$27750 = \frac{n}{2}[2 \times 200 + (n-1)50]$ ½

Þ $n^2 + 7n - 1110 = 0$ Þ (n + 37) (n – 30) = 0 n = –37 (Rejected) or n = 30 \ Delay in construction work as for 30 days. 1

½

½

20 ½

$LHS = \frac{(1+\cos A)^2+(\sin A)^2}{\sin A\,(1+\cos A)}$ 1

$= \frac{2+2\cos A}{\sin A(1+\cos A)}$ 1

$= \frac{2(1+\cos A)}{\sin A\,(1+\cos A)}$ ½

$= \frac{2}{\sin A}$ = 2 cosec A = RHS ½

OR 1

$LHS = \frac{(sinA+\cos A)^2+(\sin A-cosA)^2}{(\sin A-cosA)\,(sinA+\cos A)}$ 1

$= \frac{\sin^2 A + \cos^2 A + 2sinA\cos A + \sin^2 A + \cos^2 A - 2\,sinA\cos A}{\sin^2 A - \cos^2 A}$ 1

$= \frac{2}{\sin^2 A-\cos^2 A} = RHS$

21 Scalene. Justification: Coordinates of A, B and C are respectively (-3, -4), (3, 0) and (-5, 0). 1

$AB = \sqrt{52}$

$BC = \sqrt{8}$ ½

$CA = \sqrt{20}$ Clearly AB ¹ BC ¹ CA \ The given triangle is scalene. Area = ½ BC × (^ from A on BC) = ½ (8 × 4) = 16 sq. units ½

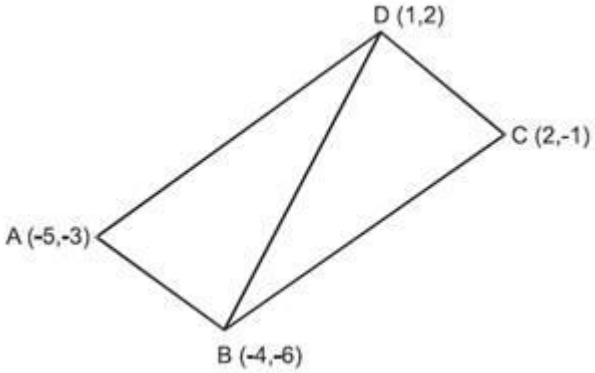
1

22 ½

1

1

½

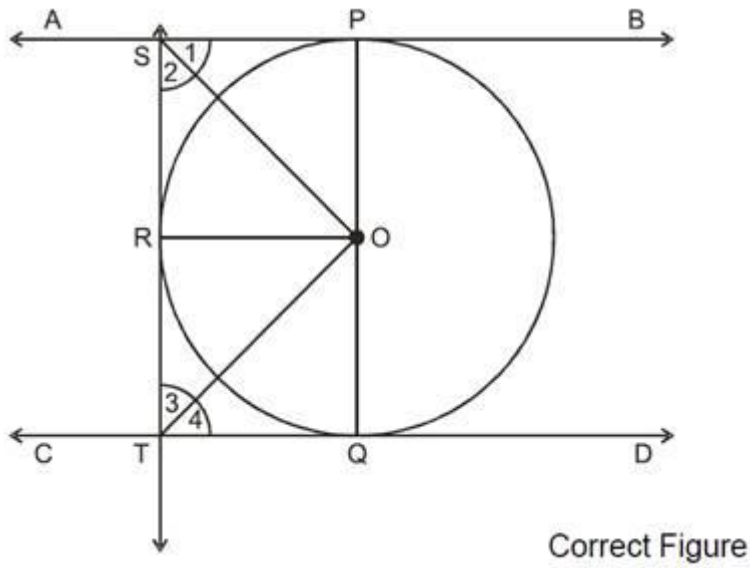


Area of quad ABCD = D area ABD + area D BCD. Area D ABD = ½ [–5 (–6 – 2) – 4 (2 + 3) + 1(–3 + 6)].

$= \frac{23}{2}\ sq.units$ Area D BCD = ½ [- 4 (-1-2) + 2 (2 + 6) +1 (-6+1)]

$= \frac{23}{2}\ sq.units$ Area of quad ABCD =

$\left(\frac{23}{2} + \frac{23}{2}\right) = 23\ sq.units$

23	For construction of ABC For construction of the required similar triangle	1 2
24	 Correct Figure	½ 1 ½ ½ ½

Since tangent is perpendicular to the radius: ÐSPO = ÐSRO = ÐOQT = 90° In right triangles OPS and ORS, OS = OS (Common) OP = OR (Radii of circle) \DOPS @ DORS (RHS Congruence) \ Ð1 = Ð2 Similarly Ð3 = Ð4 Now Ð1 + Ð2 + Ð3 + Ð4 = 180° (Sum of angles on the same side of Transversal) Þ Ð2 + Ð3 = 90° \ ÐSOT = 90°

25 Let the side of the square be ‘a’ metres. $5 \times a^2 = 720$ a = 12 m \ Perimeter of square = 48 m Þ Perimeter of triangle = 48 m Þ Side of triangle = 16 m ½

Now Area of triangle = ½

$\frac{\sqrt{3}}{4} \times 16 \times 16$

$= 64\sqrt{3}\ m^2$ ½

Cost of maintaining the park = Rs.

$(10 \times 64\sqrt{3})$ = Rs. 1

$(640\sqrt{3})$

OR ½

Radius of sphere = 3 cm Volume of sphere = 1

$\frac{4}{3}\pi \times 3 \times 3 \times 3$ = 36 pcm^3 Radius of spherical ball = 1 cm Volume of one spherical ball = ½

$\frac{4}{3}\pi \times 1 \times 1 \times 1$

$= \frac{4\pi}{3}\ cm^3$ 1

Let the number of small spherical balls be N. ½

$\left(\frac{4\pi}{3}\right) \times N = 36\pi$

\ N = 27

26 **Section D** 1

Let the number of students who arranged the picnic be x. \ Cost of food for one student = ½

$\frac{240}{x}$

New cost of food for one student = 1

$\frac{240}{x-4}$

½

$\frac{240}{x-4} - \frac{240}{x} = 5$ 1

Þ $x^2 - 4x - 192 = 0$

$(x - 16)(x + 12) = 0$

x = 16 or x = –12 (Rejected) 1

No of students who actually went for the picnic = 16 – 4 = 12

OR ½

Let the usual speed of plane be x km/hour. ½

Time taken =

$\left(\frac{1500}{x}\right)$ hrs. with usual speed 1

Time taken after increasing speed =

$\left(\frac{1500}{x+250}\right)$ hrs ½

$\frac{1500}{x} - \frac{1500}{x+250} = \frac{1}{2}$ 1

Þ $x^2 + 250x - 750000 = 0$

Þ $(x + 1000)(x - 750) = 0$ ½

Þ x = 750 or – 1000 (Rejected)

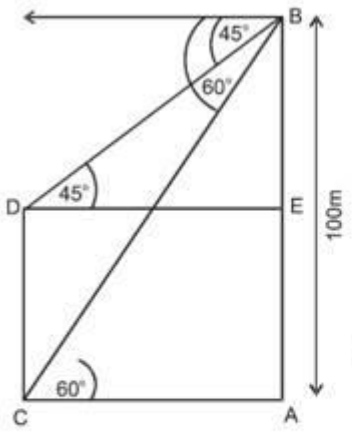
\ Usual speed of the plane = 750 km/h. 1

1

½

½

27 1



1

Correct Figure

½

In right Δ BAC, $\frac{AB}{AC} = \tan 60°$

1

$\frac{100}{AC} = \tan 60°$

½

$\Rightarrow AC = \left(\frac{100}{\sqrt{3}}\right)$ m.

1

½

In right DBED,

$\frac{BE}{DE} = \tan 45° = 1$ BE = DE \

1

$BE = \left(\frac{100}{\sqrt{3}}\right)m$. Height of the tower (CD) = AE = AB – BE

1

$= \left(100 - \frac{100}{\sqrt{3}}\right)m$ = 42.27 m Distance between the foot the building and the bottom of the tower (AC) = 57.73 m.

½

OR

1

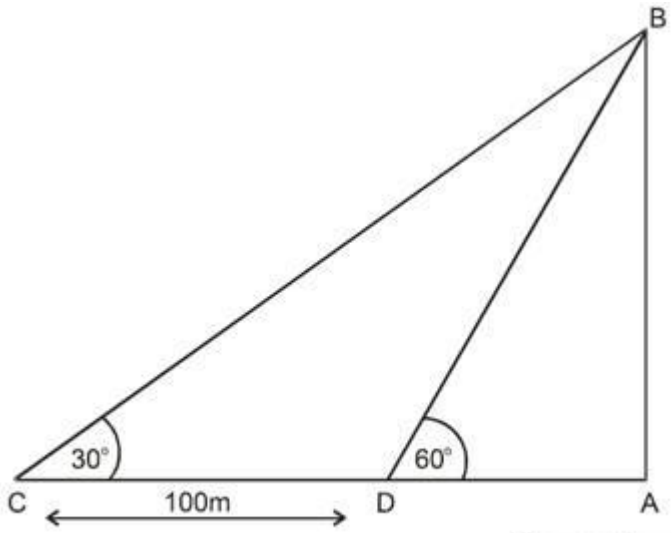
½

1

½

1

½



Correct figure

In right DBAC,

$\frac{AB}{AC} = \tan 30°$

$AB = (100 + AD) \times \frac{1}{\sqrt{3}}$ (i) In right BAD,

$\frac{AB}{AD} = \tan 60°$ AB = AD ×

$\sqrt{3}$ From (i) and (ii), we get (ii)

$\frac{100 + AD}{\sqrt{3}} = AD \times \sqrt{3}$ 100 + AD = 3AD Þ AD = 50 m From (ii) AB =

$50\sqrt{3}m$ = 50 × 1.732 m Or, AB = 86.6 m

28

Fig, Given, To Prove, Construction ½ x 4 = 2 2

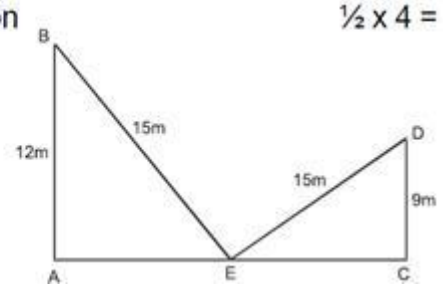
Proof 1

2nd part of the question: ½

AE = 9m. ½

CE = 12m. 1

width of street = 21 m.



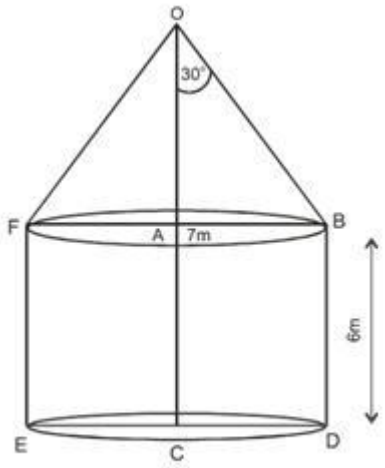
29 1

1

½

1

1



Correct Figure. 1

½

Internal curved surface area of cylinder = 2prh = 2p × 7 × 6 m^2

$= 2 \times \frac{22}{7} \times 7 \times 6\ m^2$ = 264 m^2 In right DOAB,

$\frac{AB}{OB} = \sin 30^\circ$

$\frac{7}{OB} = \frac{1}{2}$ \ Slant height of cone (OB) = 14 m Internal curved surface area of cone = prl

$= \frac{22}{7} \times 7 \times 14$ = 308 m^2 Total Area to be painted = 264 + 308 = 572 m^2 Cost of painting = Rs (30 × 572) = Rs 17160

30 The given data can be written as - Marks No of students 0 - 10 7 10 - 1

20 14 20 - 30 13 30 - 40 12 40 -

50 20 50 - 60 11 60 - 70 15 70 -

80 8 1

$Mode = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$ Here Modal class is 40 - 50 1

$\therefore\ Mode = 40 + \frac{(20-12)}{(2\times20-12-11)} \times 10$ 2

$= 40 + \frac{80}{17}$ = 44.7

1